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MARSHALL STAR

In This Week's Star

Smooth Sailing: Space Launch System Giving Marshall, Langley Wind Tunnels a Workout
By Bill Hubscher

Launching rockets is no easy, or inexpensive task. There are many considerations, including the ground support infrastructure, the fuel elements and the flight hardware itself; not to mention the safety of everyone involved.

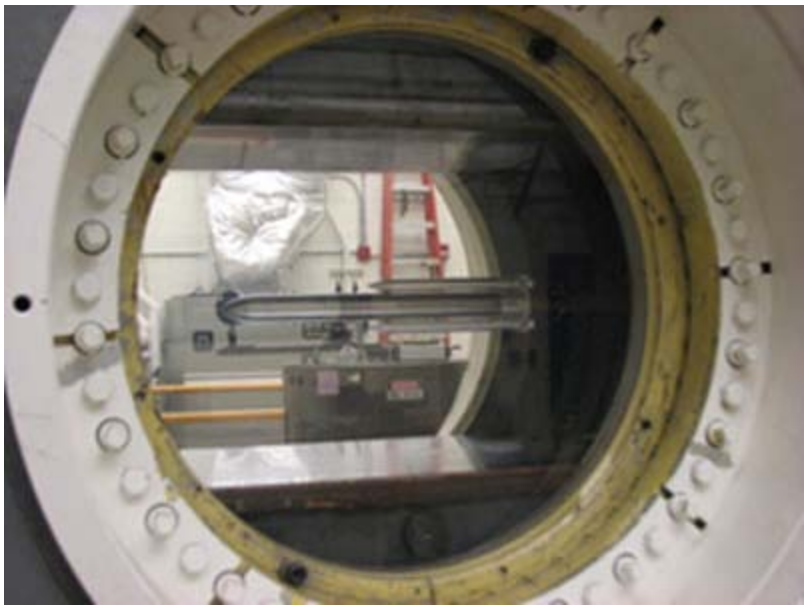
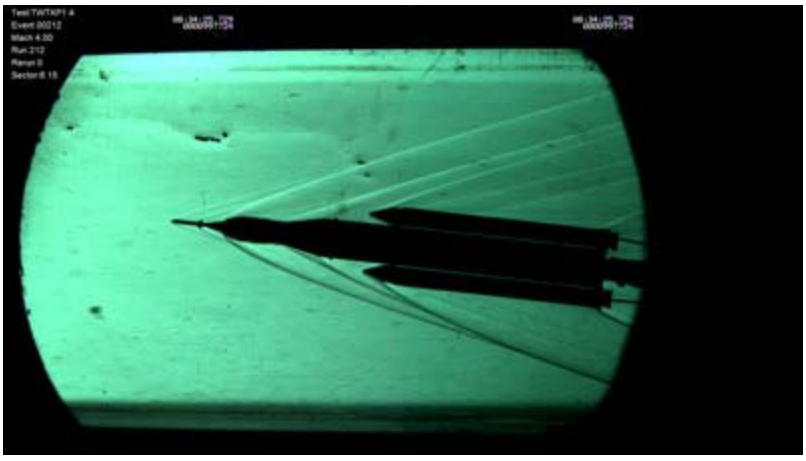


Image right: Engineers at the Marshall Center test the 130-metric-ton heavy-lift configuration of the Space Launch System rocket in the Trisonic Wind Tunnel in Building 4732. (NASA/MSFC)

Engineers use test flights to see how their designs fly through the air. However, long before that first launch, wind tunnel testing provides an early look at how the vehicle performs.

Since well before the inception of NASA, developers of rockets have used wind tunnels and scale models to determine how the vehicle responds and interacts with the atmosphere. The Marshall Space Flight Center and Langley Research Center continue to lead engineering development using wind tunnels, this time with a busy schedule of testing NASA's Space Launch System.



Engineers at Marshall's Trisonic Wind Tunnel in Building 4732 have spent the past four months putting early SLS scale models through their paces, running more than 900 tests of various crew and cargo configurations.

Image left: The 70-metic-ton configuration of the SLS rocket, designed to carry the Orion spacecraft, is tested in Marshall's Trisonic Wind Tunnel. This view uses special cameras and a deflection of light directed through the windows in the tunnel to show the shadows of airflow as it changes angles at high speeds, helping visualize the various intense pressures of atmosphere on the model. (NASA/MSFC)

"We need to evaluate all the possible conditions that the launch vehicle may encounter as it traverses the atmosphere," said John Blevins, SLS lead engineer for aerodynamics and acoustics. "We look at many different configurations and designs of the same rocket, discovering how it reacts under variations in flight conditions. It is a very busy and exciting time for us."

The Trisonic Wind Tunnel is providing the initial configuration testing and the basis to assess flight stability. Testing on a larger geometric scale at Langley's Unitary Plan Wind Tunnel and at the Boeing Polysonic Wind Tunnel in St. Louis will improve the fidelity of the database for the vehicle as the design matures. The Langley facility can accurately test limits of rocket designs, but only at speeds above Mach 1.5. The Boeing facility will be used for the lower Mach conditions on the larger model. At Marshall, tests are conducted to determine how the designs respond to roll, pitch and yaw at speeds from Mach 0.3 to Mach 5. The data from the wind tunnels will be merged to evaluate the design's performance, guidance and control.

"Once we analyze the data, we can determine the best configuration and refine our design of the vehicle," said SLS Chief Engineer Garry Lyles. "Any changes can be made safely, easily and inexpensively before the full-scale version is built. This helps ensure that SLS is an affordable and sustainable capability for human space exploration beyond low-Earth orbit."

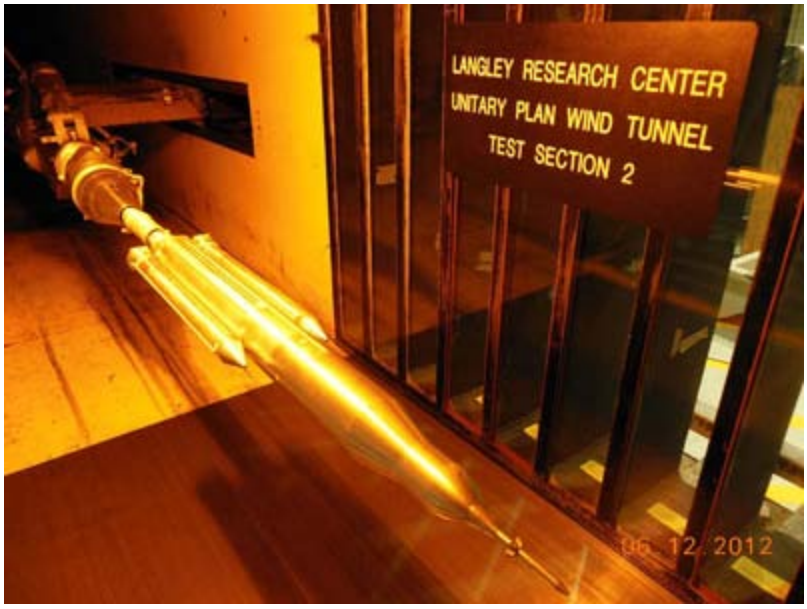


Image right: Wind tunnel testing on the 70-metric-ton configuration of SLS was also carried out at the Langley Research Center. (NASA/LaRC)

On a larger scale, engineers use wind tunnels to evaluate unsteady aerodynamic effects that can cause vehicle vibrations and resonance. The biggest SLS wind tunnel model test to date is scheduled for mid-September. Langley's Transonic Dynamics Tunnel will test the first large-scale integrated model -- a 12-foot-long version of the heavy-lift rocket to evaluate these unsteady aerodynamic phenomena.

Each test moves the agency closer to giving the nation a launch capability to take humans farther than ever before.

Hubscher, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis & Communications.

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NASA's 'Mighty Eagle' Robotic Prototype Lander Finds Its Target
NASA news release

NASA's "Mighty Eagle" successfully found its target during a 32-second free flight Aug. 16 at the Marshall Space Flight Center. This small, versatile robotic lander prototype demonstrates technologies applicable for the final descent of an autonomous controlled landing on the moon, asteroids or other celestial bodies.

Image left: On Aug. 16, NASA's Mighty Eagle robotic prototype lander successfully found its target during a 32-second, untethered test. The vehicle reached an altitude of 30 feet, where it identified an optical target painted on the ground about 21 feet away, and descended for a safe

landing. (NASA/MSFC)

The three-legged "green" lander is fueled by 90 percent pure hydrogen peroxide and receives its commands from an onboard computer that activates its onboard thrusters to carry it to a controlled landing. It is 4 feet tall and 8 feet in diameter and, when fueled, weighs 700 pounds. The test is part of a new series of free flights testing the vehicle's autonomous rendezvous and capture capabilities using an onboard camera to optically navigate to a designated target area and landing site.

The Aug. 16 flight carried the vehicle to an altitude of 30 feet, where it identified an optical target painted on the ground about 21 feet away, and descended for a safe landing.

"This is huge. We met our primary objective of this test series -- getting the vehicle to seek and find its target autonomously with high precision," said Mike Hannan, a controls engineer in Marshall's Engineering Directorate. "We're not directing the vehicle from the control room. Our software is driving the vehicle to think for itself now. From here, we'll test the robustness of the software to fly higher and descend faster, expecting the lander to continue to seek and find the target."

NASA's Mighty Eagle will help mature the technology needed to develop a new generation of small, affordable, smart, versatile robotic landers capable of achieving scientific and exploration goals throughout the solar system.

"This test-bed is a small, low-cost project that will help NASA mature technologies needed to meet future robotic science and exploration goals," said Dr. Greg Chavers, Mighty Eagle engineering lead at the Marshall Center. "What we learn here will help decision-makers map out what's needed to make landing missions possible."

The team completed 25 successful test flights in 2011 and 2012, meeting all test objectives. Previous tests validated the reusable robotic lander flight design, exercised flight and design team partnerships -- incorporating affordable, innovative, off-the-shelf flight components -- and demonstrated guidance, navigation and control algorithms.

Having completed its original mission, the vehicle now serves as a functional aerial test platform for the demonstration of new algorithms and flight sensors. Additional free flights, reaching an altitude of up to 100 feet, are scheduled through the end of September.

The Mighty Eagle prototype lander was developed by the Marshall Center and Johns Hopkins University Applied Physics Laboratory in Laurel, Md., for NASA Headquarter's Planetary Science Division, Science Mission Directorate. Key partners in this project include the Von Braun Center for Science and Innovation, which includes the Science Applications International Corp., Dynetics Corp. and Teledyne Brown Engineering Inc., all of Huntsville.

For pictures of the Aug. 16 Mighty Eagle flight, visit http://www.nasa.gov/mission_pages/lunarquest/robotic/index.html.

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More Than 300 Marshall Team Members Honored at Annual Honor Awards Ceremonies Aug. 16

The Marshall Space Flight Center honored

more than 300 employees and contractors during its Annual Honor Awards ceremonies Aug. 16. Right, NASA Acting Associate Administrator Robert Lightfoot delivers the keynote address to a standing-room-only auditorium during the events, congratulating the team for their superior accomplishments. Awards presentations were made during two ceremonies. Agency-level honor awards recognized those who have made significant achievements to NASA's mission at an agency level, and center-level honor awards recognized those who have made outstanding mission contributions to the center. (NASA/MSFC/Fred Deaton)

Honored Marshall team members line up outside the Building 4200 Morris Auditorium, ready to walk across the stage to receive their awards. Their exceptional contributions over the past year helped achieve the center's goals and further NASA's science, engineering and spaceflight endeavors -- forging a new era of exploration and discovery for the nation's space program. (NASA/MSFC/Fred Deaton)

Awards recipients and their families are treated to hors d'oeuvres and cake following the ceremonies. For a list of the NASA Honor Awards, click here. For a list of the Marshall Honor Awards, click here. To view photos of individual NASA-level recipients, visit here. (NASA/MSFC/Fred Deaton)

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NASA Selects Integrated Program Support Services Agreements
NASA news release

NASA has selected three small businesses to provide access to a variety of program support services for the agency's Marshall Space Flight Center.

Under the Marshall Integrated Program Support Services, or MIPSS, blanket purchase agreements, the following companies will lead teams to compete for task orders:

- Manufacturing Technical Solutions Inc., Huntsville
- Sumaria Systems Inc., Danvers, Mass.
- Victory Solutions Inc., Huntsville

The blanket purchase agreements have no minimum or maximum value and have a five-year ordering period. Task orders will be performance-based, fixed-price or time and material orders, and are anticipated to include a one-year base period, followed by four one-year options. Historical contractor support for similar efforts during the last five years has totaled more than $100 million.

The task orders will specify programmatic support service requirements necessary to support current and future programs and projects at Marshall. Contract services will include work in five areas; program planning and control, cost estimating and analysis, configuration management and data management, project coordination, and subject matter expert support.

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NASA Goes Green: NASA Selects Green Propellant Technology Demonstration Mission
NASA news release

NASA has selected a team led by Ball Aerospace & Technologies Corp. of Boulder, Colo., for a technology demonstration of a high performance "green" propellant alternative to the highly toxic fuel hydrazine. With this award, NASA opens a new era of innovative and non-toxic green fuels that are less harmful to our environment, have fewer operational hazards, and decrease the complexity and cost of launch processing.

Today's use of hydrazine fuel for rockets, satellites and spacecraft is pervasive. Hydrazine is an efficient propellant and can be stored for long periods of time, but it also is highly corrosive and toxic.

NASA is seeking new, non-toxic high performance green propellants that could be safely and widely used by rocketeers, ranging from government to industry and academia. Green propellants include liquid, solid, mono-propellant, which use one fuel source, or bi-propellants, which use two, and hybrids that offer safer handling conditions and lower environmental impact than current fuels.

"High performance green propellant has the potential to revolutionize how we travel to, from and in space," said Michael Gazarik, director of NASA's Space Technology Program at NASA Headquarters. "An effective green rocket fuel would dramatically reduce the cost and time for preparing and launching space missions while decreasing pollution and harm to our environment."

Following a solicitation and peer-review selection process, NASA chose the Green Propellant Infusion Mission proposal and a team lead by Ball and co-investigators from the Aerojet Corp. in Redmond, Washington, the U.S. Air Force Research Laboratory at the Wright Patterson Air Force Base in Ohio, the U.S. Air Force Space and Missile Systems Center at the Kirkland Air Force Base in New Mexico, NASA's Glenn Research Center and NASA's Kennedy Space Center for the new mission.

NASA's Green Propellant Infusion Mission is expected to be developed and flown in approximately three years. The Space Technology Program will provide $45 million for the mission, with some additional cost-sharing by mission co-investigators.

This demonstration will bridge the gap between technology development and use of green propellant. The team will develop and fly a high performance green propellant, demonstrating and characterizing in space the functionality of the integrated propulsion system. Such a demonstration will provide the aerospace community with a new system-level capability for future missions.

Maturing a space technology, such as a revolutionary green propellant, to mission readiness through relevant environment testing and demonstration is a significant challenge from a cost, schedule and risk perspective. NASA's Technology Demonstration Missions Program performs this function, bridging the gap between laboratory confirmation of a technology and its initial use on an operational mission.

The Technology Demonstration Missions Program is part of the Space Technology Program, which is innovating, developing, testing and flying hardware for use in NASA's future science and exploration missions.

For more information about NASA's Space Technology Program and Technology Demonstration Missions, visit http://www.nasa.gov/oct.

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Phoenix Cluster Sets Record Pace at Forming Stars
NASA news release

Astronomers have found an extraordinary galaxy cluster, one of the largest objects in the universe, that is breaking several important cosmic records. Observations of the Phoenix cluster with NASA's Chandra X-ray Observatory, the National Science Foundation's South Pole Telescope and eight other world-class observatories may force astronomers to rethink how these colossal structures and the galaxies that inhabit them evolve.

Image left: The hot gas in Phoenix is giving off copious amounts of X-rays and cooling quickly over time, especially near the center of the cluster, causing gas to flow inwards and form huge numbers of stars. These features are shown in this artist's impression of the central galaxy, with hot gas shown in red, cooler gas shown in blue, the gas flows shown by the ribbon-like features and the newly formed stars in blue. (NASA/CXC/M.Weiss)

Stars are forming in the Phoenix cluster at the highest rate ever observed for the middle of a galaxy cluster. The object also is the most powerful producer of X-rays of any known cluster and among the most massive. The data also suggest the rate of hot gas cooling in the central regions of the cluster is the largest ever observed.

The Phoenix cluster is located about 5.7 billion light years from Earth. It is named not only for the constellation in which it is located, but also for its remarkable properties.

"While galaxies at the center of most clusters may have been dormant for billions of years, the central galaxy in this cluster seems to have come back to life with a new burst of star formation," said Michael McDonald, a Hubble Fellow at the Massachusetts Institute of Technology and the lead author of a paper appearing in the Aug. 16 issue of the journal Nature. "The mythology of the Phoenix, a bird rising from the dead, is a great way to describe this revived object."

Like other galaxy clusters, Phoenix contains a vast reservoir of hot gas, which itself holds more normal matter -- not dark matter -- than all of the galaxies in the cluster combined. This reservoir can be detected only with X-ray telescopes such as Chandra. The prevailing wisdom once had been that this hot gas should cool over time and sink to the galaxy at the center of the cluster, forming huge numbers of stars. However, most galaxy clusters have formed very few stars during the last few billion years. Astronomers think the supermassive black hole in the central galaxy of a cluster pumps energy into the system, preventing cooling of gas from causing a burst of star formation.

The famous Perseus cluster is an example of a black hole bellowing out energy and preventing the gas from cooling to form stars at a high rate. Repeated outbursts in the form of powerful jets from the black hole in the center of Perseus created giant cavities and produced sound waves with an incredibly deep B-flat note 57 octaves below middle C, which, in turn, keeps the gas hot.

To watch an animation of the Phoenix Cluster, visit here.

"We thought that these very deep sounds might be found in galaxy clusters everywhere," said co-author Ryan Foley, a Clay Fellow at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. "The Phoenix cluster is showing us this is not the case -- or at least there are times the music essentially stops. Jets from the giant black hole at the center of a cluster are apparently not powerful enough to prevent the cluster gas from cooling."

With its black hole not producing powerful enough jets, the center of the Phoenix cluster is buzzing with stars that are forming about 20 times faster than in the Perseus cluster. This rate is the highest seen in the center of a galaxy cluster but not the highest seen anywhere in the universe. However, other areas with the highest star formation rates, located outside clusters, have rates only about twice as high.

The frenetic pace of star birth and cooling of gas in the Phoenix cluster are causing the galaxy and the black hole to add mass very quickly -- an important phase the researchers predict will be relatively short-lived.

"The galaxy and its black hole are undergoing unsustainable growth," said co-author Bradford Benson of the University of Chicago. "This growth spurt can't last longer than about a hundred million years. Otherwise, the galaxy and black hole would become much bigger than their counterparts in the nearby universe."

Remarkably, the Phoenix cluster and its central galaxy and supermassive black hole are already among the most massive known objects of their type. Because of their tremendous size, galaxy clusters are crucial objects for studying cosmology and galaxy evolution, so finding one with such extreme properties like the Phoenix cluster is important.

"This spectacular star burst is a very significant discovery because it suggests we have to rethink how the massive galaxies in the centers of clusters grow," said Martin Rees of Cambridge University, a world-renowned expert on cosmology who was not involved with the study. "The cooling of hot gas might be a much more important source of stars than previously thought."

The Phoenix cluster originally was detected by the National Science Foundation's South Pole Telescope, and later was observed in optical light by the Gemini Observatory, the Blanco 4-meter telescope and Magellan telescope, all in Chile. The hot gas and its rate of cooling were estimated from Chandra data. To measure the star formation rate in the Phoenix cluster, several space-based telescopes were used, including NASA's Wide-field Infrared Survey Explorer and Galaxy Evolution Explorer and the European Space Agency's Herschel.

The Marshall Space Flight Center manages the Chandra Program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory controls Chandra's science and flight operations.

For Chandra images, multimedia and related materials, visit http://www.nasa.gov/chandra.

For an additional interactive image, podcast, and video on the finding, visit http://chandra.si.edu.

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Obituaries

JoAnn Gooch, 71, of Madison died July 21. She retired from the Marshall Center in 1989 as a secretary.

Fred Kenner Thomas Jr., 86, of Fayetteville, Tenn., died July 27. He retired from the Marshall Center in 1978 as an equipment specialist.

Angeliene Lyle Self, 71, of Huntsville died Aug. 7. She retired from the Marshall Center in 1994 as a procurement clerk.

Gwyenneth Watson, 79, of Huntsville died Aug. 16. She retired from the Marshall Center in 1987 as a secretary.

Find this article at:

http://www.nasa.gov/centers/marshall/about/star/index.html